

Advanced Analysis and Synthesis of the Eastern Boundary Current ARI Data Set

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LONG-TERM GOAL

My long-term goal is to enhance our understanding of coastal oceanography by means of applying simple dynamical theories to high-quality observations obtained in the field. My primary area of expertise is physical oceanography, but I also enjoy collaborating with biological, chemical, acoustical, and optical oceanographers to work on interdisciplinary problems. I collaborate frequently with numerical modelers to improve their predictive capabilities of Navy-relevant parameters in the littoral zone.

OBJECTIVES

There were two objectives this year under ONR funding, one wrap-up and one new start.

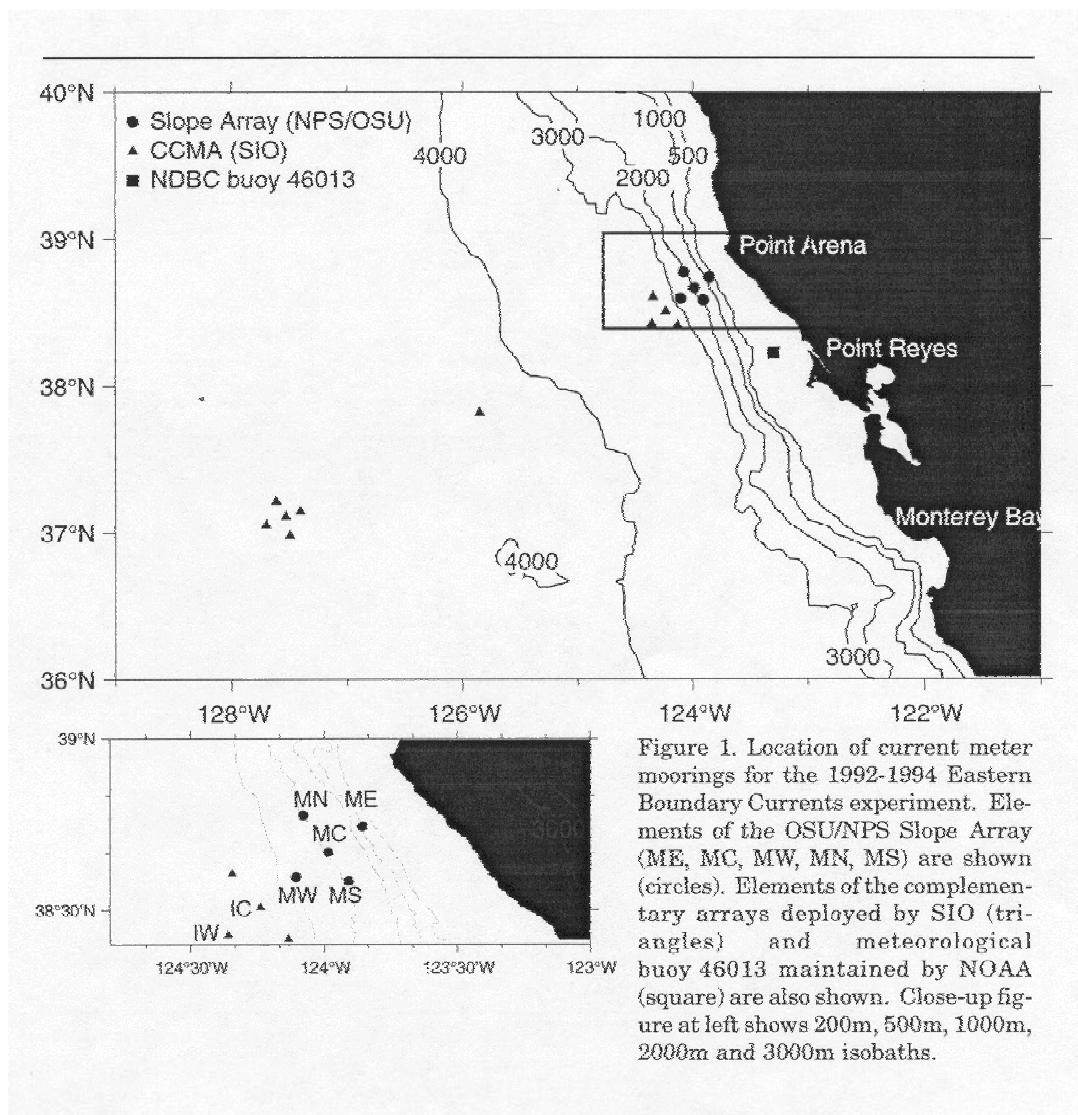
Task 1: To complete the analysis and publication of the moored array data from the ONR EBC/ARI, conducted off central California during 1992-96. Specifically, the PI is a co-author on two papers written for the *Journal of Geophysical Research*.

Task 2: The second objective of the grant was to continue working with Prof. Ching-Sang Chiu [also of NPS] planning a joint physical oceanography / environmental acoustics experiment to be conducted in one of China's neighboring seas during the 2000-2001 time period. We will continue to interact with scientists from the PRC and several other nations, most notably Singapore and Taiwan, to establish the when, where, and how of this upcoming international program.

APPROACH

Task 1: The EBC/ARI moored array consisted of three coherent local dynamics arrays (LDAs) with five moorings each, four arranged in a diamond 20 km on a side and the fifth in the center (Figure 1). The first two LDAs were contiguous across the continental slope and rise, with the third centered about 600 km offshore near 37°N, 128°W. A single "sentinel" mooring was placed halfway between the offshore and inshore LDAs to observe eddies transiting between the two. The instruments performed very well and the data return was outstanding. The first EBC manuscript [Chereskin et al., referenced below] used all 15 moorings to identify the primary modes of variability across the entire California Current System using empirical orthogonal functions (EOFs), satellite remote sensing, and spectral analysis. The second paper [Kosro, Ramp, and Smith, referenced below] focused on processes over the continental slope using mainly the five moorings in the margin (or slope) array, plus IC and IW (Figure 1).

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Task 2: A series of international workshops and dialogs was begun two years ago to implement a major field program in one of China's neighboring marginal seas. We continued this during the present funding cycle with an extended trip to Singapore and Taiwan to enlist the support of these nations in the project.

WORK COMPLETED

The EBC/ARI field program was completed during 1992-94. The work this year was on advanced analysis and writing the manuscripts for journal publication. On the first manuscript, Teri Chereskin (SIO) clearly assumed the lead role. This paper is finished and under review at JGR. Most of my effort was dedicated to the second paper [Kosro, Ramp, and Smith] which is moving ahead well now and is in advanced preparation. The plan is to publish both these manuscripts together in the same issue of JGR.

I also completed a white paper entitled, “Physical Oceanography of the South China Sea: A Summary of Present Knowledge and Plan for an ONR Coupled Oceanography/Environmental Acoustics Experiment.”

We formulated a plan for a joint field program in the South China Sea to be conducted by the U.S., People’s Republic of China, Taiwan, and Singapore. This “generic” plan, which could be executed anywhere along the PRC continental shelf, was presented to the community by G. Gawarkiewicz (WHOI) following the ASA meeting in Seattle and was very well received.

RESULTS

The continental slope region off central California was found to be an eddy generation, rather than an eddy dissipation region. Over the slope, the poleward-flowing California Undercurrent (CUC) was most prevalent, interspersed with meanders and eddies of both signs. Farther offshore, fewer eddies were observed, all deep, warm anticyclones. The eddy kinetic energy peaked near 60 days over the slope, and near 120-180 days farther offshore. Using ancillary data from other EBC/ARI investigators and the World Ocean Circulation Experiment (WOCE), the origin of one warm anticyclone offshore was traced back to the CUC [Chereskin et al., 1998].

IMPACT/APPLICATION

Task 1: It seems clear now that eddies in the California Current represent a mechanism for transporting materials from the coast to the central North Pacific. We had suspected this from earlier work [e.g. Washburn et al., 1993] but have a much more complete picture now.

Task 2: The addition of Singapore and Taiwan to the South China Sea observational effort will have a significant impact on the magnitude of our plans. Singapore (Dr. John Potter, National University of Singapore) will make much more complete ambient noise measurements than we might have otherwise. Taiwan (Dr. Wen-Ssn Chuang, National Taiwan University) will bring a second modern research vessel, a second SEASOAR instrument, and four ATLAS buoys to the physical oceanography program. These partners will allow us to conduct a much more comprehensive experiment than we could on our own.

TRANSITIONS

None

RELATED PROJECTS

1 – Current observations over the continental slope off the Farallon Islands (with C. A. Collins, NPS, and M. Noble, USGS, EPA sponsorship). Three moorings, 14 current meters, one year, to examine advection and dispersal at the EPA deep water dumpsite.

2 – The Innovative Coastal-Ocean Observing Network (ICON). Integrated observations, data assimilation, and modeling of the currents and hydrography in and around the Monterey Bay. (with J. D. Paduan, L. K. Rosenfeld, N. Garfield, C. A. Collins and C.-S. Chiu, NPS, plus seven other partners, NOPP funding).

REFERENCES

Washburn, L., M. S. Swenson, J. L. Largier, P. M. Kosro, and S. R. Ramp, 1993: Cross-shelf sediment transport by an anticyclonic eddy off northern California. *Science*, **261**, 1560-1564.

PUBLICATIONS

Chereskin, T. K., M. Y. Morris, P. P. Niiler, P. M. Kosro, R. L. Smith, S. R. Ramp, C. A. Collins, and D. L. Musgrave. Spatial and temporal characteristics of the mesoscale circulation of the California Current from eddy-resolving moored measurements. Submitted to *J. Geophys. Res.*, 1998.

Kosro, P. M., S. R. Ramp, and R. L. Smith. Currents over the continental slope off Point Arena, CA. In preparation for *J. Geophys. Res.*, 1998.